

Definitions and Concepts for Edexcel Physics A Level

Topic 5: Waves and Particle Nature of Light

Absorption Spectrum: The frequencies at which a certain element absorbs photons at a higher rate as these frequencies correspond to the spacings between energy levels in the element's atoms.

Amplitude: The maximum displacement of a vibrating particle or wave from its equilibrium position.

Angle of Incidence: The angle at which a light ray hits a medium. Measured from a line perpendicular to the surface of the medium.

Angle of Reflection: The angle at which a light ray reflects off a surface. Measured from a line perpendicular to the surface of the medium.

Angle of Refraction: The angle at which light rays travel after transferring into a different refractive index material. Measured from a line perpendicular to the surface of the medium.

Antinode: The point on a stationary wave where the incoming and reflected wave are in phase forming a maximum point.

Coherence: Waves with the same frequency and constant phase difference.

Constructive Interference: Interference when the two waves are in phase. If the two waves are both at their peak the addition of the two peaks becomes large.

Converging Lens: A lens that takes a parallel set of light rays and causes them to meet at a point.

Critical Angle: The angle of incidence when the angle of refraction is exactly 90° . It is when the refracted ray travels along the boundary line.

De Broglie Hypothesis: All particles have a wave-like nature and a particle-like nature. The wavelength of a particle is inversely proportional to the particle's momentum.

De-excitation: The movement of an electron from a high energy level to a lower energy level. This occurs in excited atoms over time and causes photons to be released.

Destructive Interference: Interference when the two waves are in antiphase. When one wave is at a peak and one is at a trough their addition results in a minimum point.

Diffraction: The spread of a wave as it passes through a gap or over an edge.



Displacement: The distance and direction that a vibrating particle or wave has travelled from its equilibrium position.

Diverging Lens: A lens that takes a parallel set of light rays and causes them to travel away from each other and not meet.

Electronvolt: The kinetic energy gained by one electron that is accelerated through a potential difference of 1 volt. Equal to 1.6×10^{-16} J.

Emission Spectrum: When a certain element's atoms de-excite they move from one energy level to another with a specific energy gap between these levels. This creates a photon of that specific energy and it is the frequencies of these photons that make up the emission spectrum.

Excitation: The movement of an electron from a low energy level to a higher energy level. This occurs when another electron or photon transfers energy to an orbital electron causing it to move to a higher energy level.

Focal Length: The distance from the centre of the lens to the focal point.

Focal Point: The point at which rays of light passing through a lens converge (or appear to converge).

Frequency: The number of complete oscillations of a wave (wave cycles) per second.

Fundamental Frequency: The oscillation of an entire object forming the lowest possible frequency for that object. For a string fixed at both ends this is where there is only a single antinode in the middle of the string.

Huygen's Principle: Every point on a wavefront can be treated as a point source of a secondary wavelet.

Ionisation: When an electron is removed from an atom giving the atom a positive charge.

In-Antiphase: When the phase difference between two waves is 180 degrees or π radians.

In-Phase: When the phase difference between two waves is 0 degrees or 0 radians.

Intensity: The power transferred by a wave per unit area.

Lens Power: The inverse of the focal length.

Longitudinal Wave: A wave whose oscillations are parallel to the direction of propagation of the wave (e.g. sound waves).

Magnification: The height of an object divided by the height of its image.



Node: The point on a stationary wave where the incoming and reflected wave are in antiphase forming a minimum point.

One-to-one Interaction: When one photon transfers all of its energy to a single electron in a photoelectric process.

Path Difference: For two waves starting from different points and arriving at the same point the path difference is the difference in the length travelled by each wave, measured in metres.

Period: The time taken for a wave to complete one full cycle.

Phase: If the full cycle of a wave (peak to peak) is represented on a circle with the first peak at 0° (0 radians), the trough at 180° (π radians) and the next peak at 360° (2π radians), the phase is where on that circle the wave is at a given point in space and time. Measured in radians or degrees.

Phase Difference: The difference in phase if the phase of two waves is determined at a single point in time, measured in radians or degrees. It can be seen as the amount by which one wave lags behind another.

Photoelectric Effect: When light of a high enough energy shone on a metal surface causes electrons to be emitted. The electrons are given enough kinetic energy by the photons to overcome the attractive force of the ions in the metal.

Polarised Wave: A wave whose oscillations have been restricted to the same plane.

Principal Axis: A passing through the centre of the lens. Passing through the axis of the lens where it is thinnest.

Progressive Wave: A wave that transfers energy from one point to another.

Pulse-Echo Technique: An ultrasound technique used for imaging of objects notably in medical imaging. Short pulses of ultrasound are sent through a medium and their reflections recorded.

Real Image: Where rays of light have actually converged to produce an image and can be projected onto a screen.

Refraction: When a wave changes speed when it crosses the boundary into a new medium.

Refractive Index: A measure of how much the speed of light changes between two different media. If one media is a vacuum then the **Absolute Refractive Index** is found. For two different non-vacuum materials the **Relative Refractive Index** is found.



Snell's Law: The relative refractive index can be found from the ratio of the sines of the angles of incidence and refraction.

Stationary Wave: A wave that stores energy instead of transferring it. A common example is a string fixed at both ends. They are formed by a wave propagating and being reflected so that it comes into superposition with itself.

Superposition: When two waves meet at the same point in space their displacements combine and the total displacement at that point becomes the sum of the individual displacements at that point. Also referred to as **Interference**.

Threshold Frequency: The minimum frequency of light needed to cause electrons to be emitted in the photoelectric effect regardless of the intensity.

Total Internal Reflection: When the angle of incidence is greater than the critical angle and the ray reflects at the surface and remains within the medium.

Transverse Wave: A wave whose oscillations are perpendicular to the propagation of the wave e.g. electromagnetic waves.

Ultrasound: Sound waves with a frequency greater than 20 kHz.

Virtual Image: When rays of light only appear to have converged and cannot be projected onto a screen.

Wavefront: The surface made up of all the points of the wave that are in phase with each other.

Wavelength: The distance between two identical points on a wave. Typically measured peak to peak or trough to trough.

Wave Speed: The distance travelled by a wave per second. The product of the frequency and the wavelength. For an electromagnetic wave in a vacuum this is always equal to c (3×10^8 m/s).

Work Function: The minimum energy required to just liberate an electron from the surface of a metal.

